

3.0022 Swarming in an Undescribed Enicocephalid (Hemiptera) from Costa Rica¹

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In August of 1969, while collecting on the Cerro de la Muerte, Costa Rica, at an elevation of about 2,700 meters, I observed the swarming flight of a previously unknown species of *Systelloderes* which will be described by Dr. Pedro Wygodzinsky in a forthcoming revision. This phenomenon has been previously observed in the Enicocephalidae by Knab (1908), Johannsen (1909), Usinger (1945) and others and recorded for two species of *Didymocephalus* in Africa by Villiers (1963); however, little is known about the habits of the family and very few records on their biology are present in the literature.

My first observations were on August 2, 1969, in and around an uncut forest of *Quercus copeycensis* about 5 km SE of Villa Mills, Cartago Province. This forest type is the dominant vegetation at approximately 2,500–3,000 meters elevation on the Cordillera de Talamanca. It consists mostly of *Q. copeycensis* with occasional specimens of other species such as *Podocarpus* sp. The close spacing of the trees, which was seldom over 10 meters, coupled with high rainfall (about 2 meters annually) and cool temperatures (mean about 12° C) produced a very damp forest, luxuriant with mosses, ferns, orchids and bromeliads. Some low areas with standing water were present. Shafts of sunlight struck the forest floor through opening in the oak canopy which was about 25–30 meters in height.

At about 10:00 A.M. with a clear sky and a temperature of 16° C, swarms of what were thought to be chironomids were seen. After collecting some I determined that they were in fact enicocephalids. The numbers of individuals in each swarm were probably from 200–500; the largest swarms were observed in the forest, but smaller swarms were seen in cleared areas adjacent to the forest and in another open area at Villa Mills. The swarms themselves moved little in a horizontal plane and shifted from 1–2 to 3–4 meters above the ground. The flight of individuals was hovering and rather clumsy. Members of the swarms had two distinct types of movements: most of the time they seemed to maintain their relative positions with respect to one another; periodically the entire swarm went into a swirling-mixing movement, and a few individuals would drop from the swarm and then fly back up into it.

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During the latter behavioral stage mating was apparently taking place. I was able to collect copulating pairs by standing under the swarms and allowing the individuals to land on me. Mating position was with the male and female oriented in the same direction and the male situated on top of and slightly to one side of the female. Of a total of 441 individuals collected, only 7 were females!

The forest was visited on August 5 to look for specimens and gather additional ecological information. The entire morning was spent searching possible habitats and no specimens were found. The only data on the habitat was collected by Douglas Futuyma on August 3, in the Oak Forest, where he found a few specimens in the forest floor litter layer which contained some mosses and ferns. Usinger (1945) comments that he encountered swarms of hundreds of thousands of individuals of *Systelloderes angustatus* (Champion) in Southern Mexico, but careful searching on subsequent days yielded only a very few specimens. Wygodzinsky (personal communication) notes that he has found rather large numbers of enicocephalids on and in the ground after swarming, but only with considerable effort. (The species referred to by Usinger as *S. angustatus* is actually undescribed and more closely related to the species discussed in this paper than to any other (Wygodzinsky, personal communication).)

Swarming in this species appears to involve a rather precise timing mechanism. Observations were made in the forest on August 2, 3 and 5; the insects were observed flying only on the first day. This does not negate the possibility that swarming did not take place on days previous to August 2, but since such large numbers were present on the one day and none on subsequent days I suspect that this was not the case. Usinger (1945) implies that swarming, as he observed it in Mexico, was of rather limited duration. Johannsen's (1909) observations of *S. biceps* (Say) over a considerable number of sequential summer evenings, would indicate, however, that some species may have "seasonal" swarming habits.

The observations of Knab (1908) and Usinger (1945) in southern Mexico and Johannsen (1909) in New York indicate that swarming took place in the evening just before sundown. My observations in Costa Rica show swarming taking place in the morning. If climatic (weather) factors are important in initiating swarming, it may be that it could not take place in the afternoon on the Cerro de la Muerte, because, at least during certain parts of the year (including August) torrential rains lasting throughout the afternoon are the rule.

Little information is available on reproductive behavior in the Heteroptera, but no records indicate mating behavior similar to that of the enicocephalids in other members of the order. Usinger and Matsuda (1959) cite

records of what are apparently dispersal flights for California species of Aradidae, but do not indicate that these have any particular significance for mating. In the Enicocephalidae swarming definitely seems to involve mating and dispersal. This swarming has been likened to that of Nematocerous Diptera (Knab, 1908), and does in fact seem to be a very similar phenomenon.

Barring the possibility of a very specialized habitat which I may have overlooked, population density would appear to be low, judging from my sampling. I would think that the inability to find specimens in an area where apparently extremely large numbers are present is a result of cryptic coloration, seclusive habits, clumped distribution or an even redistribution after swarming, rather than the insects having mated, oviposited and died, which does not appear to be what happens in most Heteroptera.

This peculiar type of behavior in the Heteroptera further substantiates the isolated nature of the Enicocephalidae in the Heteroptera as indicated by the work of Cobben (1968) on the eggs of Heteroptera and that of Leston, Pendergrast and Southwood (1954).

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ABSTRACT.—The swarming behavior of the Enicocephalidae, unique in the Heteroptera, is discussed for an undescribed species of *Systelloderes* from the mountains of Costa Rica. Previous records of this phenomenon are cited.—T. SCHUB.

Descriptors: Hemiptera; Enicocephalidae; *Systelloderes*; swarming; Costa Rica; mating behavior.